

## Review

## Oral sex and the transmission of non-viral STIs

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**Objectives:** To review the literature on the role of oral sex in the transmission of non-viral sexually transmitted infections (STIs).

**Method:** A Medline search was performed using the keywords oro-genital sex, and those specific to each infection. Further references were then taken from each article read.

**Conclusions:** Oral sex is a common sexual practice between both heterosexual and homosexual couples. Oro-genital sex is implicated as a route of transmission for gonorrhoea, syphilis, *Chlamydia trachomatis*, chancroid, and *Neisseria meningitidis*. Other respiratory organisms such as streptococci, *Haemophilus influenzae*, and *Mycoplasma pneumoniae* could also be transmitted by this route. Fellatio confers risk for acquisition of infection by the oral partner. Cunnilingus appears to predispose to recurrent vaginal candidiasis although the mechanism for this is unclear, while a link between oro-genital sex and bacterial vaginosis is currently being studied. Oro-anal sex is implicated in the transmission of various enteric infections. In view of the increased practice of oral sex this has become a more important potential route of transmission for oral, respiratory, and genital pathogens.

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Keywords: oral sex; STIs; enteric infections

### Introduction

This is the second of two articles which look at the transmission of infection via oral contact. The term oral sex in this context is taken to include oro-genital and oro-anal contact but not oro-oral contact.

The conditions will be divided into the following categories: vaginal infections, syphilis, gonorrhoea, *Chlamydia trachomatis*, tropical STIs, enteric infections, and respiratory tract organisms.

### Vaginal infections

#### CANDIDIASIS

Vulvovaginal candidiasis is not usually a sexually transmitted infection, with constitutional factors (such as oral contraceptive use or antibiotic therapy) having a small significant association.<sup>1</sup> However anecdotal reports suggest that oral contact (cunnilingus) may predispose to recurrent infection,<sup>2–5</sup> and that this may be related to the amount of saliva which comes into contact with the genitalia.<sup>2</sup> Rates of colonisation of the oral cavity in healthy individuals vary between 20% and 50%<sup>4</sup> so it is biologically plausible that colonisation of the vagina could occur following contact. However, Evans *et al*<sup>5</sup> reported on a series of 1025 new attenders at a genitourinary medicine clinic, and found no association between oral sex and candidiasis. In contrast, two studies of recurrent vaginal candidiasis have shown a significant association with the practice of cunnilingus ( $p < 0.001$ ),<sup>6</sup> frequency of oral intercourse ( $p = 0.02$ ), and oral intercourse within the past month ( $OR = 3.1$ ).<sup>7</sup> If oral sex predisposes to recurrent vaginal candidiasis but not to vaginal candidiasis in general this suggests that the mechanism for predisposition might not be oro-genital transmission of the organism. A possible explanation of these apparently paradoxical findings might be the

antimicrobial substances (for example, thiocyanate, lysozyme, and nitric oxide) in saliva<sup>8</sup> which could perhaps have a similar effect to antibiotics—that is, they kill bacteria but allow the resilient candida spores to survive and give rise to recurrent candidiasis.

Candidal balanoposthitis is rarer than vulvovaginitis, and tends to be sexually acquired with high rates of infection in partners.<sup>9</sup> Data on particular sexual practices are lacking.

#### BACTERIAL VAGINOSIS

The role of sexual transmission in bacterial vaginosis (BV) remains unclear; some studies show similar risk behaviour in groups with BV and other sexually transmitted infections,<sup>1–11</sup> but others refute this.<sup>5,12</sup> The contribution of oro-genital contact is also debated; Evans *et al*<sup>13</sup> found a concurrent rise in BV and frequency of oro-genital sex among women in London between 1982 and 1992, suggesting a possible link which is now being studied. In a study of four organisms associated with BV (*Mobiluncus curtisii*, *M. mulieris*, *Mycoplasma hominis*, and *Gardnerella vaginalis*) the organisms were commonly found in the rectum suggesting colonisation from that site.<sup>14</sup> However, *M. hominis* was found in the throats of two patients who had BV and also in their partners, and in six men whose partners all carried *M. hominis* vaginally, suggesting the possibility of oro-genital transmission of this organism. A history of having ever performed fellatio has also been found to be significantly associated ( $p < 0.05$ ) with pharyngeal infection with *M. hominis*.<sup>15</sup> Elshibly *et al* failed to find a link between vaginal carriage of *M. hominis* and regular oral sex.<sup>16</sup>

#### TRICHOMONIASIS

Trichomoniasis (TV) has become much less common over recent years but remains a marker for other sexually transmitted

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Table 1 Evidence for the transmission of non-viral STIs by oral sex

Infection	Nature of risk	Evidence	References
Vaginal candidiasis	Increased risk of recurrent vaginal candidiasis with cunnilingus	Case reports	2, 3
Bacterial vaginosis	Possible increased rates with oral sex	Association with cunnilingus and frequency of oral sex	6 7
	Asymptomatic pharyngeal infection in partners	Concurrent rise in BV and oral sex	13
		Pharyngeal infection in male partners of women with BV	15
		Association between fellatio and pharyngeal infection with <i>M hominis</i>	15
Trichomoniasis	Unknown	Transmission between lesbians (possibly by fomites)	20
Syphilis	With fellatio: to oral partner to penile partner	Oral chancres	23, 24, 25
		Mucous patches of secondary syphilis	25
Gonorrhoea	Fellatio, oral partner	Pharyngeal gonorrhoea (+/- symptoms)	26, 29, 30, 32
	Cunnilingus, oral partner		27, 29, 31
	Rimming, oral partner		28
	Fellatio, penile partner	Urethral infection	35
<i>Chlamydia</i> (D-K)	Fellatio, oral partner	Asymptomatic pharyngeal infection	37, 40, 41
Lymphogranuloma venereum		No evidence	
Donovanosis	? to oral partner	Occasional oral lesions	45-48
Chancroid	? to oral partner	Oropharyngeal isolation in partner of patient with genital ulceration	52
Enteric infections	Rimming, oral partner	Symptomatic GI infection	55, 57, 63, 66, 69, 70
	Fellatio, oral partner	Increased prevalence in homosexual men	57, 70 54, 56, 59, 60, 64, 65
<i>Neisseria meningitidis</i>	Fellatio, penile partner	Cases of urethritis	72, 73, 74, 75, 76, 77
	Cunnilingus, vaginal partner	Reports of cervicitis/PID/vulvovaginitis	77, 78, 80, 81
	Rimming	Rectal isolates (usually asymptomatic)	76, 79
<i>Moraxella catarrhalis</i>	Fellatio, penile partner	Cases of urethritis	84, 85
	Receptive partner	Isolation from anogenital sites	76, 82
		Also causes neonatal conjunctivitis	87, 88, 89, 90
Streptococci	Fellatio, penile partner	Balanitis due to group A	93, 94, 95
<i>Haemophilus influenzae</i>	Cunnilingus, vaginal partner	Case reports of septic abortion after oral sex	96, 97
	Fellatio, penile partner	Isolates from urethra	100
<i>Mycoplasma pneumoniae</i>	Cunnilingus, vaginal partner	Strains isolated from the cervix	101

infections.<sup>17</sup> Isolation of TV from the urethra of male sexual partners of infected women is variable but low; in one series 60% were negative on examination and investigation.<sup>18</sup> This series included 513 episodes of infection in women and 92 episodes in men, none of whom had oro-pharyngeal symptoms. Oro-genital sex was not found to be a risk factor for infection by Evans *et al.*<sup>5</sup> Non-venereal transmission by fomites has been postulated in some cases, but is thought to be unlikely.<sup>19</sup> Transmission has occurred between lesbians whose only contact has been mutual masturbation and oro-genital sex<sup>20</sup> although the relative importance of each type of contact is unclear. *Trichomonas vaginalis* has not been isolated from the mouth or throat, and has only rarely been associated with respiratory infection. Cases of vertical transmission from infected mothers have been reported,<sup>21</sup> but there are no cases reported in adults even with immunodeficiency; therefore, oropharyngeal carriage and subsequent transmission appear unlikely.

### Syphilis

The decline of syphilis over recent years at a time when sexual practices are changing has meant that recent reports of oro-genital transmission are lacking. However, information from Mindel *et al* from a 20 year period indicate the risk of oro-genital transmission. Rates of syphilis were higher in the homosexual group, who had more sexual partners and a higher incidence of STIs<sup>22</sup> although sexual practices were not detailed. However, data on the clinical features among these patients suggest oral transmission; oral chancres occurred in 10 of the 728 homosexual men and in one of the 29 heterosexual women who were infected, but in none of the heterosexual men.<sup>23</sup> This would suggest that fellatio may constitute a risk to the oral partner. In secondary syphilis oral mucous patches were found in 16%, 19%,

and 22% of each of the above groups, thus providing another possible route of spread.<sup>23</sup> Fiumara and Berg also describe the cases of three homosexual men with primary chancres in the oral cavity, one of whom had been a contact of gonorrhoea, while the others had been contacts of secondary syphilis.<sup>24</sup> The practice of oro-genital sex between these patients and their partners was not mentioned, but the conclusion was that the lesions were due to oro-genital sex or kissing. Another series reported 15 homosexual patients presenting with primary or secondary syphilis whose only contact was oro-genital sex with the receptive partner being most at risk.<sup>25</sup>

### Gonorrhoea

Gonococcal infections of the oral cavity have been recognised for many years, as has the link with oro-genital sex.<sup>26</sup> While pharyngitis is a relatively common clinical manifestation of gonorrhoea, gonococcal stomatitis has also been reported, following cunnilingus with an infected partner.<sup>27</sup> In fact, Tikjob *et al* found that 14/74 (19%) of patients with pharyngeal gonorrhoea had positive cultures of *Neisseria gonorrhoeae* from the vestibulum oris.<sup>28</sup> Among patients with gonorrhoea, rates of pharyngeal infection are higher in homosexual men (20.9–25%) and heterosexual women (10%) than heterosexual men (3.2–7%) and are significantly associated with the practice of fellatio.<sup>29 30</sup> The link between pharyngeal infection and cunnilingus is less clear as numbers of heterosexual men with pharyngeal infection are low, but in one series 14% of men who admitted cunnilingus with the presumed infected partner, acquired pharyngeal gonorrhoea. This compares with a rate of pharyngeal infection of 3% among those men who denied cunnilingus.<sup>29</sup> The difficulty of obtaining an accurate history of oro-genital sex (and therefore of establishing its true role in transmission

of STIs) is illustrated by the findings of Osborne and Grubin.<sup>31</sup> Of 1453 patients examined for pharyngeal gonorrhoea, 42 cases were found. Only 27 of these gave histories of oro-genital sex, although all 42 reported this form of sexual contact when questioned again at a follow up visit. Eleven of the infected men were asymptomatic heterosexuals whose only oro-genital contact was cunnilingus.<sup>31</sup> The majority of pharyngeal gonorrhoea is asymptomatic—79% in one study<sup>29</sup>; however, 15% reported a sore throat and 5% had purulent tonsillitis. Disseminated infection from pharyngeal infection acquired by oro-genital sex (fellatio) has also been reported.<sup>32</sup> A history of a sore throat is significantly related to fellatio, with or without the presence of gonorrhoea.<sup>29</sup> Fellatio has been reported to cause palatal erythema and purpura,<sup>33</sup> and it seems plausible that trauma may influence the acquisition of infection. Gonococci have also been isolated from the anterior oral cavity in many patients with pharyngeal infection<sup>28</sup> and transmission by kissing has been suggested, as some infected patients deny oro-genital contact. Although a case report by Willmott<sup>34</sup> suggests kissing as a cause of reinfection after treatment, in a larger series there were no matched pairs who had pharyngeal infection as the only manifestation of disease.<sup>30</sup> Evidence for transmission from the throat to genitals comes from a retrospective review of cases of male gonococcal urethritis at a USAF clinic in the Philippines in 1980 which revealed 46 cases of probable oral to genital transfer of *N gonorrhoeae* among more than 2600 cases of gonococcal urethritis.<sup>35</sup> Oro-anal sex has been implicated as the only risk factor for acquisition of pharyngeal gonorrhoea in three men who admitted to this practice but denied oro-genital sex.<sup>28</sup>

### Chlamydia

*Chlamydia trachomatis* infection is a common infection in England and Wales and rates of infection have not declined over recent years.<sup>36</sup> Many women have few symptoms and therefore do not seek treatment, while providing a reservoir of infection. It is therefore difficult to assess the contribution of oro-genital sex to the spread of infection. *C trachomatis* has been isolated from the pharynx of a homosexual man after fellatio,<sup>37</sup> and also in a patient who denied any oral contact.<sup>38</sup> *C trachomatis* has been isolated from throat material in patients suffering from chlamydial ocular infection.<sup>39</sup> This was presumed to result from contamination of the throat by nasolacrimal secretions.<sup>37</sup> In a study of chlamydial infection in homosexual men in Scotland, 1.3% were found to have evidence of pharyngeal infection.<sup>40</sup> In heterosexuals in the United States *C trachomatis* has been isolated from the pharynx in 3.7% of men and 3.2% of women, and in women it was found to be significantly related to having performed fellatio ( $p=0.01$ ).<sup>41</sup> *C trachomatis* has been isolated from the lower respiratory tract in immunosuppressed patients with pneumonia (although sexual histories were not reported)<sup>42 43</sup> which could suggest a respiratory reservoir for infection or a non-sexual mode of transmission.

### Tropical sexually transmitted infections

Ethnicity and religion influence age of first intercourse,<sup>44</sup> but no data could be found on their influence on the practice of oro-genital sex. The frequency of oral manifestations of tropical STIs will clearly be influenced by cultural attitudes to oro-genital sex.

#### LYMPHOGRANULOMA VENEREUM

This is an uncommon tropical sexually transmitted infection, with no data on oro-genital spread. As *Chlamydia trachomatis* D-K serotypes can be detected in upper respiratory tract samples, it seems plausible that the L1–3 serovars may also infect this area. However, evidence of this is lacking.

#### DONOVANOSIS

The presence of oral lesions of granuloma inguinale (GI) is very rare; in a series of 867 cases of GI described by Ramachander *et al*<sup>45</sup> only one case had oral lesions while another had a lesion on the mandible. There are other sporadic reports of lesions in the mouth in patients with<sup>46</sup> and without a history of oro-genital contact<sup>47 48</sup>; in the former the lesions occurred 18 months after the treatment of genital lesions. It therefore seems unlikely that the mouth forms a reservoir for infection, and no strong evidence exists to support oro-genital transmission as a route of infection.

#### CHANCROID

Chancroid is the commonest cause of genital ulceration in the developing world accounting for 48% of all genital ulcers in a study of Kenyan women.<sup>49</sup> In the developed world the prevalence is lower, but the number of cases has risen in the United States during the 1980s.<sup>50</sup> *Haemophilus ducreyi* has been isolated from the urethra of men with symptomatic urethritis, but in none of a group of men with culture positive genital ulcers without urethritis<sup>51</sup> suggesting that asymptomatic carriage is rare. Apparent oro-genital transmission has been described in three cases. In one of these cases *H ducreyi* was isolated from the female partner's genital ulcers and the male partner's oropharynx.<sup>52</sup> No evidence of transmission has been proved from culture positive asymptomatic women<sup>53</sup> and carriage therefore cannot be taken to imply infectivity.

### Enteric infections

Sexual transmission of enteric infections between homosexual men was first reported in the 1970s, when it was noted that a disproportionately large number of cases of shigellosis were found in homosexual men.<sup>54</sup> This was followed by reports of sexual transmission of other enteric pathogens. There is little evidence on the transmission of these infections in heterosexuals, which may relate to the lower rates of endemicity in that population or to differences in sexual practices.<sup>55</sup> The following discussion therefore relates to infections in homosexual men only.

#### BACTERIAL

Shigellosis in homosexual men was originally reported from San Francisco, where homo-

sexual activity was reported by 30 of the 50 patients.<sup>54</sup> Similar findings in homosexual men were reported by Drusin *et al* in a retrospective survey, although individuals' particular sexual practices were not identified.<sup>56</sup> In a further study, 90% of the affected men reported fellatio and/or oro-anal contact.<sup>57</sup> *Salmonella* species are also thought to be spread by the practice of anilingus and fellatio after anal intercourse, but the intermediate dose and the efficacy of the gastric acid barrier protect most individuals from infection after sexual contact.<sup>58</sup> *Campylobacter jejuni* and *Campylobacter*-like organisms have been found to cause diarrhoea in homosexual men,<sup>59</sup> with a polymicrobial aetiology being common, suggesting a shared route of infection.<sup>60</sup> Rectal spirochaetosis (with a non-syphilitic strain) has been described in homosexual men, and is of uncertain significance, the condition having been demonstrated on biopsy in 28 of 100 symptomatic homosexual men,<sup>61</sup> and by culture in 39% of symptomatic and 16% of asymptomatic men in another study.<sup>62</sup> Law *et al* found that biopsy evidence of spirochaetosis was significantly associated ( $p < 0.05$ ) with oro-anal sex and with *Entamoeba histolytica* infection ( $p < 0.05$ ).<sup>63</sup>

#### PROTOZOAL

Pathogenic and non-pathogenic amoebae are found more commonly in homosexual men, may be asymptomatic, and may be endemic in the homosexual population in some cities.<sup>64</sup> The prevalence of *Entamoeba histolytica* in Canada was found by Keystone *et al* to be 67.5% in homosexual men and only 16% in heterosexual men, with a protective effect noted for cleansing before anal sex,<sup>65</sup> while other studies show a significant risk from oro-anal contact.<sup>55 66</sup> *Giardia lamblia* infection is also found more frequently in homosexual men although at a lower prevalence than *E. histolytica*.<sup>55 65</sup> When cases were first described faecal-oral spread was postulated, but sexual practices were not examined,<sup>67 68</sup> but more recently a significant association ( $p < 0.001$ ) has been observed with oro-anal contact.<sup>66</sup> Other organisms may be transmitted similarly—for example, three cases of *Isospora belli* enteritis have been reported in HIV positive homosexual men, two of whom admitted to oro-anal sex.<sup>69</sup> This may be important in the context of diarrhoea in immunocompromised patients.

#### HELMINTHS

These are also passed between male sexual partners, and cases following oro-penile and oro-anal contact have been reported.<sup>70</sup> Oro-anal sex has been identified as a risk by Phillips *et al*.<sup>55</sup>

A similar method of transmission has been postulated for all of these infections and the rate of transmission may be affected by the inoculum received and whether it is inactivated by gastric acid. It is therefore not surprising to find many cases of coinfection with more than one agent.<sup>55 66 71</sup>

#### Respiratory tract organisms

While the mouth and respiratory tract may form a reservoir of infection allowing the transmission of sexually transmitted infections through oral sex, conversely infections not previously thought to be sexually acquired may be passed in the same manner. Some of the possible organisms are discussed below.

#### NEISSERIA MENINGITIDIS

Meningococci have been isolated from the genitourinary tract of patients both with<sup>72-81</sup> and without<sup>76 78 79 82</sup> symptoms. Urethritis due to meningococci was first reported in 1942,<sup>72</sup> and several case reports suggest that it may be associated with oro-genital contact.<sup>73-75 77</sup> Meningococci have been isolated from the pharynx of the partner in several cases and found to be identical serotypes to the genital isolates.<sup>73 77</sup> Infection is commoner in homosexual men than in either heterosexual men or women<sup>76 78 79</sup> and more likely to be anal than urethral in these patients (15 of 731 and three of 669 isolates respectively).<sup>79</sup> Symptomatic proctitis appears uncommon.<sup>76</sup> Rectal infection has also been reported in women<sup>79 82</sup> but no more frequently than cervical infection,<sup>82</sup> perhaps suggesting that rimming may be an important factor in homosexual men. Symptomatic disease in women has been described and includes purulent cervicitis,<sup>77 80</sup> vulvovaginitis,<sup>81</sup> and salpingitis,<sup>77 78</sup> although asymptomatic infection appears commoner than in urethral infection.<sup>76</sup> The overall prevalence of ano-genital meningococcal infection in the United Kingdom remained unchanged over a 13 year period, at 0.13% of patients screened,<sup>76</sup> although in America, Hagmen *et al* found that *N. meningitidis* accounted for 20% of urogenital isolates of pathogenic *Neisseria* in their laboratory.<sup>77</sup> It has also been suggested that some patients have an increased susceptibility to infection with *Neisseria* species—in a study of 150 patients who had experience of oro-genital sex, *N. meningitidis* was six times more frequent in patients with concomitant genital gonorrhoea.<sup>83</sup> This suggests either that the presence of *N. meningitidis* may be a facilitator for gonococcal infection or that other factors predispose to both these *Neisseriae*.

#### MORAXELLA CATARRHALIS

This respiratory organism has also been isolated from ano-genital samples in both men and women, but less commonly than *N. meningitidis*.<sup>76 82</sup> Urethritis has been reported in men<sup>84-86</sup> supporting a role for oro-genital transmission, although one case involved a 13 year old boy<sup>86</sup> and does not mention possible routes of infection; thus fomite spread cannot be excluded. Although numbers of isolates in each series are small *M. catarrhalis* seems to be most commonly isolated from the rectum.<sup>76 82</sup> Cases of ophthalmia neonatorum have also been reported<sup>87-90</sup> but uro-genital infection of the mother was not proved in any of these. However, in one review of ophthalmia neonatorum, 14 cases were diagnosed as gonococcal on microscopy alone although this can not differentiate between *N. gonorrhoea* and *M. catarrhalis*.<sup>91</sup>

## STREPTOCOCCAL INFECTION

Balanitis due to group A streptococci has been reported mainly in children with a concomitant streptococcal sore throat,<sup>92</sup> but only rarely in adults. However, there are case reports of balanitis or penile pyoderma caused by group A streptococci after the patient has received fellatio.<sup>93-95</sup> The more common group B streptococcal balanitis has been linked to vaginal as opposed to oro-genital sex. There are no reports of streptococcal infections in women following cunnilingus.

## HAEMOPHILUS INFLUENZAE

Septic abortion associated with *Haemophilus influenzae* has been reported; in one case occurring 72 hours after oral sex,<sup>96</sup> and in another oral sex was implicated.<sup>97</sup> However, the organism has also been isolated from a child with vaginitis<sup>98</sup> and a tubo-ovarian abscess<sup>99</sup> where the route of transmission is uncertain but possibly haematogenous in the latter. *H. influenzae* has also been isolated from the urethra of three of 85 men attending a sexually transmitted diseases clinic, but no comment was made on the route of acquisition.<sup>100</sup>

## MYCOPLASMA PNEUMONIAE

*Mycoplasma pneumoniae* strains have been isolated from the cervix in a series of 22 women attending a gynaecology clinic,<sup>101</sup> and was also found in the urethra of one of the three male sexual partners examined. A history of oral sex was found in 50% of cases. Although transmission via oral contact seems plausible, haematogenous spread may occur—a case of tubo-ovarian abscess has occurred following pneumonia.<sup>102</sup>

## OTHER

There are infrequent reports of other oral pathogens being isolated from the urogenital tract—for example, *Capnocytophaga* chorioamnionitis after oral sex,<sup>103</sup> or *Entamoeba gingivalis* colonisation of the uterus in the presence of an intrauterine device.<sup>104</sup>

Oral sex has also been examined as a risk factor in non-specific urethritis and pelvic inflammatory disease, where no specific causative agent has been identified. In pelvic inflammatory disease patients had sex more often than controls ( $p < 0.001$ ) and more frequently reported oral sex ( $p < 0.05$ ), but did not have significantly more sexual partners or a younger age at first intercourse.<sup>105</sup> A strong association (odds ratio 11.4) was also found between insertive oral sex and the development of *Chlamydia* negative *Ureaplasma* negative non-gonococcal urethritis.<sup>106</sup>

## Conclusion

Oro-genital sex is implicated as a route of transmission for gonorrhoea, syphilis, *Chlamydia trachomatis*, chancroid, and *Neisseria meningitidis*. It is plausible that respiratory organisms such as streptococci, *Haemophilus influenzae*, and *Mycoplasma pneumoniae* could also be transmitted via this route. Cunnilingus appears to have a role in predisposing to recurrent vaginal candidiasis but this might occur by mechanisms other than oro-genital transmission of

candida. A possible link between oro-genital sex and bacterial vaginosis is currently being studied. There is little information regarding the possibility of oro-genital transmission of trichomoniasis, lymphogranuloma venereum, or donovanosis. Oro-anal sex is implicated in the transmission of various bacterial, protozoal, and helminthic infections. In view of the increased practice of oral sex this has become a more important potential route of transmission for oral, respiratory, and genital pathogens.

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